

gives some further details about the discovery of this comet. In the Monthly Register of the Society for Practical Astronomy (vol. vii., No. 1, January and February, 1915), Mr. Mellish narrates how he first saw the comet on the morning of February 9. Daylight made it impossible to determine any motion of the object, and he had to wait until the following morning, February 10, before he was able to observe its slow movement, and thus recognise the object as a comet. Its position was R.A. 17h. 2m., and declination $+3^{\circ} 15'$. The comet is described as being $3'$ in size, bright, and having a very short, fan-shaped tail.

ASTRONOMY AND THE WAR.—A correspondent of the *Morning Post* (April 23), writing from Paris on April 22, relates how astronomy is found among the victims of the war. At Nantes, he relates, "an electric tramway built out to an English camp put all the instruments in the observatory for the registration of terrestrial magnetism out of order, and made observation impossible. The observatory of the Puy de Dôme found itself cut off from the outside world at an altitude of 5000 ft. The funicular on which it depended in time of peace stopped working, and all the horses had been commandeered, so that the astronomers had the choice between leaving their post and being starved. Happily the problem was solved by the artillery dépôt of Clermont-Ferrand, which undertook the task of provisioning the observatory."

ELECTRIC FURNACE SPECTRA OF VANADIUM AND CHROMIUM.—The results of some very interesting experiments with regard to the variation with temperature of the electric furnace spectra of vanadium and chromium appear in the current number of the *Astrophysical Journal* (March, vol. xl., No. 2, p. 86), by Dr. A. S. King. The author has been able to record his observations at three separate temperatures, which he denotes as high, medium, and low. The temperatures on which the classification is based were recorded by a Wanner pyrometer, and were 2500 – 2600° C. for the high, 2300 – 2350° C. for the medium, and 2000 – 2150° C. for the low temperature. The metals used were metallic vanadium and crystalline chromium of "fair purity," and the furnace tubes used were of re-graphitised Acheson graphite. The paper gives two tables of the intensities of the lines measured under the three temperatures, together with the arc intensities; several reproductions from the spectra are also included. The conclusions drawn indicate that the spectra of these substances develop similarly to those of iron and titanium, vanadium being very like titanium. The chromium spectrum near the temperature at which the vapour begins to radiate predominates in Class I. lines (lines relatively strong at low temperatures and strengthen slowly at higher temperatures), which change little at higher temperatures. Certain chromium lines, very diffuse in the arc in air, may be resolved into sharp components in a vacuum source, either furnace or arc. A large number of lines belonging to various furnace classes are relatively weak in this arc. The spectrum increases into the ultra-violet as the temperature rises. The ability of lines to show self-reversal in the furnace distinctly increases with decreasing wave-length. The absence in the furnace of banded spectra which appear in the arcs of vanadium and chromium indicates that they are probably due to the oxides of the metals.

RECENT PAPERS IN THE "ASTRONOMISCHE NACHRICHTEN."—A large number of the issues of the *Astronomische Nachrichten* came to hand together last week, and while the material included is of too great and varied a nature to be dealt with in this column, it may help readers to know some of the chief contents.

For this reason the following curtailed list of communications is given:—No. 4797: Observations of long-period variables (1914), by A. A. Nijland. No. 4796: Observations of the planet Jupiter, by H. E. Lau. No. 4795: Numerical investigations on a class of periodic orbits, by Carl Burran and Elis Strömberg; observations of comet 1913f (Delavan), by A. Abetti. No. 4793: The variable star W Cygni, by G. Hornig; Observations of SS=V 19 Cygni, by A. A. Nijland. No. 4792: Tables for the computation of precession for stars near the pole, by L. de Ball; ephemeris of the periodic comet of Tempel 2, Johannes Braae. No. 4791: Determination of the position of third order points on the moon's surface, by K. Graff and W. Voss; observations of the star BD 89.1°, with the large refractor of the Berlin Observatory, by L. Courvoisier. No. 4787: Observations and elements of the Algol star 10, 1914, R. S. Canum Venaticorum, by Cuno Hoffmeister; elements and ephemeris of the periodic comet of Winnecke for the appearance in 1915, by K. Hillebrand. No. 4786: Definite orbit of comet 1890 III., by S. Ogura and H. Kaneko; observations of Algol stars, by R. Lehnert; the orbit of comet 1913f (Delavan), by G. van Biesbroeck. The contents of the Nos. 4777 to 4785 will be given next week.

THE "GAZETTE ASTRONOMIQUE."—In this column for December 24 last reference was made to the proposed publishing in this country of the *Gazette Astronomique*, the monthly bulletin of the Antwerp Astronomical Society, should sufficient financial aid be forthcoming. It is satisfactory to be able to record the appearance of the first number, but its continuance will depend on the support given to it in the future. The present issue contains an interesting account in English of the Uccle Observatory under German occupation, a description of a photograph of Delavan's comet, taken by M. G. van Biesbroeck in September last, a series of notes on astronomical current literature, etc. The first number promises well for future issues.

BRITISH GEOLOGY.

THE series of memoirs published by the Geological Survey of Great Britain on the South Wales Coalfield reaches part xi. in the description of "The Country around Haverfordwest" (1914, price 3s. 6d.). Dr. Strahan is fortunate in having colleagues who, like himself, have become devoted to this particular ground. The district here described includes a considerable development of the Llandovery series, which is divided into local stages; the lowest of which rests, with an occasional conglomeratic facies (pp. 78 and 201), on rocks of Upper Bala age, while the highest stage laps over on to far older series. The Lower Old Red Sandstone is unconformable with the beds below it, and contains plant-remains, which are unfortunately indeterminate. The structure and economic features of the eastern part of the Pembroke-shire Coalfield are described.

The pre-Glacial wave-cut platform, recognised in southern Ireland is shown to exist also at Milford Haven (p. 214). Dr. Strahan (p. 220) points out how the older glacial drift of the area was brought in from the north-west, and even from the west, by a lobe of the Irish Channel ice. Through a recent subsidence, the rock-floors of the valleys tributary to Milford Haven lie far below sea-level, and a submerged forest with flints worked by man, which were recognised by A. L. Leach, occurs at Amroth on Carmarthen Bay.

Memoir No. 83 of the Scottish series (1914, price 2s.) deals with "The Country round Beaully and Inverness." The names of J. Horne and B. N. Peach are still to be seen happily associated on its cover,

with those of younger colleagues. One of the most striking features of the district is the Great Glen fault, which, despite its Caledonian trend, is later than some of the folding of the Old Red Sandstone, and has here a minimum throw of 6000 ft. The river-scenery is finely illustrated, and attention is directed (p. 82) to a deep pre-Glacial channel at the mouth of the valley of the Ness, the rock-floor of which has not been reached at 290 ft. below Ordnance datum. The Strathpeffer Spa, with its sulphur-bearing springs, is the main economic feature of the district. In a region so rich in human history, we wish that a geological survey might trench farther on the field of the geographer and the archæologist.

Drs. Peach and Horne have provided a description of the "Geological Model of the Assynt Mountains"

very large area. We miss a reference in the memoir to the old tale of the "Caithness grin," which was said to be developed among a hospitable folk by sighting a stranger across miles of level flagstone. The evidence for a Middle Old Red Sandstone Series, which was sustained by J. W. Evans in 1891, is fully substantiated in this memoir, in consequence of the studies made by Traquair on the fossil fishes. These include the interesting *Palæospondylus* at Achanarras. We should like to have a further account of the flora of the Caithness strata, beyond the brief references on pp. 5 and 81. The successive stages of deposition of the Old Red Sandstone in "Lake Orcadie" are well shown in diagrams on pp. 84 and 85. A downward warping of the Caledonian continental surface allowed of the accumulation, as Sir A. Geikie long ago esti-



Thurso Flags (Upper Caithness Flags) cut by a typical ravine or "goe," south of Duncansby Head. Many of these "goes" are of pre-Glacial origin. Reproduced from the Memoir to Sheets 110 and 116, by permission of the Controller of H.M. Stationery Office.

(1914, price 1d.), which is exhibited in the Museum of Practical Geology, the Royal Scottish Museum, Edinburgh, and elsewhere. This modestly priced pamphlet, with its numerous sections, forms an excellent introduction for the student to the classic district of the Highland overthrusts.

The memoir to Sheets 110 and 116, entitled "The Geology of Caithness" (1914, price 4s.), is by C. B. Crampton and R. G. Carruthers. The maps (2s. 6d. each) with the memoir show a thinly populated country formed mainly by Old Red Sandstone, and descending from the Highland region northward, until it becomes, in comparison, a plain with "monadnocks," now stretching at about 150 ft. above the sea. Peat, as the useful system of shading shows us, covers a

estimated, of some 16,000 ft. of Caithness flags. The origin of red strata in a warm and fairly dry climate, where vegetation exists, but not in sufficient quantity to acidify the soil, is discussed in chapter ix. The considerable amount of calcium carbonate in the flagstones is attributed to an arid epoch, here called a cycle, affecting the deposits on the shores.

The suggestion (p. 100) of the sudden suffocation of fish by the inflow of alluvium is supported by a recent observation of E. Kolb during his descent of the Arizona canyons. The gills of the fish were, however, in this recent case choked by mud during flooding of the stream, and not in a period of marginal recession.

The nearness of Cretaceous masses to the north-

east coast of Scotland, and the possibility of the existence of outliers beneath the Glacial drift, is shown by the account (p. 131) of the Cretaceous sandstone of Leavad, which was recognised by D. Tait in 1906. This block, 240 yards in length, is used as a sand-quarry, and rests on a green clay which, from its foraminifera, G. W. Lee regards as perhaps of Pliocene age. This in turn rests on boulder-clay, so that, as happens in Ostpreussen (NATURE, vol. lxxxv., p. 470), local geology has been distinctly enriched by material imported during the Ice age.

The Geological Survey states that the issue of some of its colour-printed maps is delayed by work necessitated by the war; but it makes its own contribution to military needs in a pamphlet on "Sources of temporary water supply in the south of England and neighbouring parts of the Continent" (1914, price 2d.). The waters of sand-dunes, alluvium, and river-gravels are especially considered, and useful warnings are given as to pollution. It is remarked (p. 10) that a well sunk in sand or gravel on a chalk hill may lose its water if carried down to the surface of the porous chalk.

The proceedings of local societies, especially where universities are at hand to provide a stimulus, afford valuable supplements to the publications of the official surveys. The second part of vol. xv. of the Transactions of the Geological Society of Glasgow (price 7s. 6d.) forms an admirable example. All the papers record original observations in southern Scotland. Prof. J. W. Gregory (p. 174) treats of the red rocks of the Isle of Arran, which he regards as including Permian desert-beds at Brodick. These terrestrial deposits are, he urges, Lower Permian, and the appearance of conformity with the Keuper Marls above may be deceptive. G. W. Tyrrell (p. 188) describes critical sections in spots which he visited at Prof. Gregory's request, and is unable to discover any break in the sedimentation. The papers by P. Macnair, R. G. Carruthers, and J. E. Richey on the lower beds of the Carboniferous Limestone Series will do much to help workers in other districts, such as the north of Ireland. G. A. J. C.

EXPERIMENTAL BOTANY AT TRINITY COLLEGE, DUBLIN.

IN "Notes from the Botanical School of Trinity College, Dublin," No. 5, vol. ii., 1915, Prof. H. H. Dixon gives experimental proof that morbid changes spread through plants from branches killed by heat. If a portion of a branch be killed by heat and the substances dissolved as the result of the heating be washed away, morbid changes only take place after some fourteen days. In cases where no steps are taken to remove the poisonous substances liberated by the heating, the branches above the heated portion show morbid changes in the course of five days. It is clear from the experiments that with the killing of the cells by heat, substances are liberated into the sap which contaminate the water supply to the living tissues above, and that the morbid changes are not due to the cutting off of the supply of water.

In a further paper in the same number of the "Notes" Prof. Dixon gives the result of his investigations into the nature of the changes which are produced in the sap by the heating of the branches. Sap was extracted by means of a centrifuge from pieces of branches, and was examined both fresh and after steaming for the acidity, colour, presence of oxydases and quantity of dissolved substances. The steamed sap showed marked acidity, a much higher percentage of dissolved substance—indicated by the depression of the freezing point—and a development of colour, any oxydase pre-

sent being, of course, destroyed. The presence of poisonous properties was proved by placing leaves of *Elodea canadensis* in the steamed and in fresh sap, when it was noticed that lethal effects were produced quickly by the steamed sap, and that the leaves would not recover when placed in water.

In a paper on the tensile strength of sap, Prof. Dixon records tensions of about 207 atmospheres and 132 atmospheres in a tube of sap collected from a branch of *Ilex aquifolium*. The former of these is probably the highest yet recorded for the cohesion of any liquid. The tensile strength of the sap of trees, like that of water, is considerable, but it is probably somewhat more stable under tension than pure water. Prof. Dixon and Miss Marshall have also examined the elements of the wood of trees in relation to the ascent of sap, and find no evidence to support Janse's hypothesis as to the intervention of the living cells in the ascent of sap in stems.

Mr. W. R. G. Atkins publishes a series of careful papers on oxydases and their inhibitors in plant tissues, and his work confirms that of Keeble, Armstrong, and Jones. The distribution of oxydases in the flowers of Iris has been particularly studied; when they are kept in darkness, the quantity of active peroxydases increases. In the Pogoniris group an active peroxydase is absent. The localisation of oxydases and catalases in some marine Algæ has also engaged the attention of the author.

ENGINEERING, EDUCATION, AND RESEARCH.¹

RESEARCH.—Research for the solution of new problems is of great importance, but it is not a task for young and immature students. Many so-called researches, in which well-understood methods are applied to materials or subjects not themselves important, scarcely deserve the name. They amount to little more than class exercises. Most scientific societies receive papers in which a much over-elaborated description is given of known proceedings and precautions, in which the new results are of limited value without establishing any general law. But the value of real research, based on a clear formulation of a definite unsolved problem, cannot be overestimated.

Unfortunately, in engineering, the solution of unsolved but important problems is generally both difficult and expensive. Much, no doubt, is done by manufacturers who have a financial interest in the work. But their researches are, in general, not fully published. It is of great interest to the public at large and to other engineers that a scientific institution like this feels it part of its duty to advance knowledge by research, and is able to devote a fraction of its income for such researches as are beyond the means of private engineers. In most cases, a research committee of this institution begins by an investigation of what has been done before, and the summary of previous investigations which the institution publishes is not only a safeguard against mere repetition of experiment, but is valuable in itself. Prof. Martens, the director of the great State laboratory at Grosslichterfelde, has said that in four cases out of five when a manufacturer brings him a problem, it is found that it has already been solved somewhere by somebody.

The War and Engineering.—We meet in circumstances not foreseen a year ago. A war of unprecedented magnitude, extending over a vast area, has broken on us with the suddenness and fury of a tropical storm. We are already proud of the courage

¹ From the presidential address delivered to the Institution of Mechanical Engineers on April 16 by Dr. W. Cawthorne Unwin, F.R.S.